Speed-of-Sound Measurements for Gaseous 1.1,1-Trifluoroethane (R-143a)

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The speed-of-sound measurements with a spherical resonator are recognized as one of the best approaches to understand the thermodynamic behavior of very rarefied gases. A spherical acoustic resonator was developed for measuring the speed-of-sound in gaseous refrigerants from which the ideal gas heat-capacities and second virial coefficients are accurately derived.

A hydrofluorocarbon, R-143a, 1,1,1-trifluoroethane (CH₂FCHF₂) is expected to be a component of the binary and ternary refrigerant mixtures with R- 125 and with other HFCs to replace R-502 (R-22 48.8%, R-115 51.2%), because of its zero ozone-depletion potential.

In the present study, sixty-three speed-of-sound measurements in gaseous R-143a with an accuracy of 72 ppm were obtained at temperatures from 273 to 343 K and pressures from 10 to 500 kPa with the spherical acoustic resonator. The ideal-gas heat-capacities and the second virial coefficients have been determined from the present speed-of-sound measurements.

The difference of the present ideal-gas heat-capacity values from the theoretical calculated values based on the spectroscopic data and the second virial coefficients determined through new data processing from the speed-of-sound measurements are discussed